

Instructor	Dr. Mahmoud Reda Taha, P. Eng Professor, Regents' Lecturer and Chair Centennial Engineering Center: 3006 Tel: 277-1258, e-mail: mrtaha@unm.edu
Lectures	Once Weekly: Friday 9:00 – 11:30 Mechanical Engineering 220
Course Description	This course explains principles of crack initiation propagation and the fracture process in construction materials including glass, metals, concrete and polymers. This course covers the fundamental theories governing crack initiation and propagation and fracture theory in materials based on stress and energy criteria. The course also provides example applications of fracture theories to design components under fatigue and testing concrete under compression and tension stresses.
Lecture Notes	Lecture notes will be developed by the class and the instructor. We will discuss the different topics every week. One group will give half the lecture weekly followed by discussions and Instructor Lecture and Notes. We have a weekly reading assignment from many sources.
Course Objectives and Student Learning Outcomes	Students taking these course will be able to <ul style="list-style-type: none">- Calculate fracture toughness based on principles of linear elastic fracture mechanics- Predict fatigue life of components under cyclic stresses using principles of fatigue crack initiation and propagation- Evaluate fracture toughness of metals and nonlinear materials using principles of elastic plastic fracture mechanics- Predict concrete cracking and crack propagation using theory of quasi-brittle fracture mechanics- Explain concrete testing data under compression and tension stresses using principles of fracture in compression.- Evaluate damage in materials from structural health monitoring data using theory of damage mechanics-
Office Hours	Tuesday & Thursday 2:00 – 3:00 pm or by appointment. You can always communicate with us by email.
References	<u>Books</u> <ul style="list-style-type: none">-Anderson, T. L., Fracture Mechanics: Fundamentals and applications. Second or Third Editions, CRC Press, 1995- Shah, S. P., Swartz, S. E., Ouyang, C., Fracture Mechanics of Concrete, John Wiley & Sons, 1995.- Broek, D. Elementary Engineering Fracture Mechanics. Martinus Nijhoff Publishers, 4th edition, 1986.- Lemaitre, J., Desmorat, R. Engineering Damage Mechanics, Ductile,

Creep, Fatigue and Brittle Failures, Springer 2005

Articles

- About 50 articles on fracture mechanics of materials

Assignments

- Material reading is a weekly assignment prior to attend the class
- Four assignments will be given throughout the semester

Course Project

A project on fracture mechanics and its application to a special practical engineering problem is expected. Projects shall be initiated by the students. Up to two students can collaborate as a team in one project. Further details will be provided by the instructor.

Expected performance

Students are expected to be familiar with engineering-programming environments such as MATLAB, MathCad and Excel. Examples in these programs will be used. It is the duty of the student to get familiar with these programs. Feel free to ask the instructor if you have questions in these programs.

Accommodation Statement

Accessibility Services (Mesa Vista Hall 2021, 277-3506) provides academic support to students who have disabilities. If you think you need alternative accessible formats for undertaking and completing coursework, you should contact this service right away to assure your needs are met in a timely manner. If you need local assistance in contacting Accessibility Services, see the Bachelor and Graduate Programs office.

Academic Integrity

The University of New Mexico believes that academic honesty is a foundation principle for personal and academic development. All University policies regarding academic honesty apply to this course. Academic dishonesty includes, but is not limited to, cheating or copying, plagiarism (claiming credit for the words or works of another from any type of source such as print, Internet or electronic database, or failing to cite the source), fabricating information or citations, facilitating acts of academic dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of other students. The University's full statement on academic honesty and the consequences for failure to comply is available in the college catalog and in the Pathfinder.

Cell Phones and Technology

As a matter of courtesy, please turn off cell phones, pagers, and other communication and entertainment devices prior to the beginning of class. Notify me in advance if you are monitoring an emergency, for which cell phone ringers should be switched to vibrate.

**Library and
Tutorial Services**

UNM-Main campus provides many library services and some tutorial services for distance students. For library services, go to <http://www.unm.edu/libraries/> to link to a specific library or to contact a librarian. For tutorial services, go to <http://caps.unm.edu/online> to explore UNM's online services.

Grading

Component	% Final Grade
Assignments	10
Mid-term	20
Final Exam	25
Course Project	25
Class participation	20
Total	100%

CE 504 Course Syllabus - Tentative Schedule

#	Date	Topic
1	January 22	<i>Introduction to Fracture Mechanics</i>
2	January 29	Linear Elastic Fracture Mechanics (LEFM)
3	February 5	Linear Elastic Fracture Mechanics (LEFM)
4	February 12	Fatigue: Stress and Strain Based Approach
5	February 19	<i>Guest Lecture Dr. Maji on NDT for Crack Detection</i>
6	February 26	Fatigue: Fracture Mechanics Based Approach
7	March 4	Elastic Plastic Fracture Mechanics: CTOD & J-Integral
8	March 11	Fracture in Polymers and Viscoelastic Materials
--	March 18	SPRING BREAK
--	March 25	MID-TERM EXAM
9	April 1	Fracture in Compression
10	April 8	Fracture Mechanics of Concrete
11	April 15	Size Effect in Concrete and Other Materials
12	April 22	Fracture Mechanics Testing in Concrete and Other Materials
13	April 29	Damage Mechanics
--	May 6	PROJECT PRESENTATIONS
--	May 11	TAKE HOME FINAL EXAM

Student Lecture Evaluation FORM

Each Item to take a grade of 10 for a Total Grade of 100

	Student Name			Remarks
TECHNICAL EXPERTISE				
1- Command of the Subject Matter				
2- Organization of Lecture				
3- Contact with Audience				
4- Enthusiasm, Energy and Confidence				
5- Clarity of Presentation				
6- Precision of Explanations				
7- Voice (<i>volume, speed, variation</i>)				
8- Visual Aids and Demonstrations				
9- Time Management				
10- Questioning & Answering Questions				
TOTAL GRADE (OUT OF 100)				